

REMARKS

Claims 1-26 will be pending upon entry of the present amendment. Claims 1, 7-9, 11, 14, 16 and 18 are amended. Claims 24-26 are new. No new matter is being presented.

Applicants thank the Examiner for withdrawing the finality of the rejection of the previous Office Action dated February 23, 2007.

In the current Office Action, claims 1-2, 4-5, 7-8, 10, 16, 18 and 20 were rejected under 35 U.S.C. § 102(b) as being anticipated by UK Patent Application 2 208 774 to Morgan et al. ("Morgan").

Morgan does not disclose the invention recited in amended claim 1. Claim 1, as amended, recites a motion estimation method that includes:

determining a primary global motion vector for the selected group  
from all of the corresponding block motion vectors;

classifying the block motion vectors from the selected group into a  
plurality of sub-groups, each of the plurality of sub-groups including a plurality of  
the block motion vectors of differing values;

determining a plurality of secondary global motion vectors  
corresponding to the respective sub-groups from the block motion vectors  
classified in the respective sub-groups; and

selecting the primary and/or at least one of the secondary global  
motion vectors for use in defining one or more search windows for each block in  
the selected group to enable block matching with a reference picture

Morgan does not disclose determining a plurality of secondary global motion vectors corresponding to the respective sub-groups from the block motion vectors classified in the respective subgroups. Rather, Morgan simply discloses selecting the eight most common local motion vectors and labeling them as global motion vectors based on frequency of occurrence and other criteria (Morgan page 16, lines 3-5). In particular, the only potential sub-groups in Morgan are the group of global motion vectors and the group of motion vectors that did not become global motion vectors, and Morgan never determines a secondary global motion vector corresponding to either of these "sub-groups". Applicants respectfully disagree with the

Examiner's assertion that Morgan's use of a frequency array to count the occurrence of local motion vectors is analogous to grouping motion vectors into sub-groups of vectors of the same co-ordinate value (Office Action page 9). Morgan uses the frequency array to count the occurrence of local motion vectors (excluding "long vectors"), and the eight most common vectors that pass various threshold tests (such as a "predetermined difference threshold" and a "global threshold") are labeled global motion vectors (Morgan page 15, lines 5-32, to page 16, lines 1-5). Morgan does not mention or show any sub-groups of local motion vectors (other than the potential subgroups mentioned above), and certainly does not determine a secondary global motion vector from block motion vectors classified in a respective sub-group.

Nevertheless, in the interest of furthering prosecution, Applicants have amended claim 1 to clarify additional aspects. In particular, amended claim 1 recites "each of the plurality of sub-groups including a plurality of the block motion vectors of differing values". Nowhere does Morgan disclose or suggest classifying block motion vectors into a plurality of such sub-groups. Even assuming, for the sake of argument, Morgan's frequency counting is analogous to classifying block motion vectors into sub-groups of the same coordinate value, as the Examiner suggests, Morgan does not teach or suggest classifying block motion vectors into sub-groups comprised of motion vectors with differing values.

For at least the foregoing reasons, amended claim 1 is allowable over Morgan.

Claims 2, 4-5, 7, and 20 depend from amended claim 1, and are thus allowable over Morgan for at least those reasons discussed above.

In addition, claim 2 recites additional features not disclosed in Morgan. Claim 2 recites "wherein the block motion vectors from the selected group are classified into the sub-groups according to spatial clustering of the block motion vectors." Morgan does not disclose classifying block motion vectors into sub-groups according to spatial clustering of the block motion vectors. The Office Action refers to a section of Morgan that discusses a frequency array that is uniquely addressed by values of local motion vectors, such that a local motion vector is used to "address the [frequency] array and to increment the [frequency] array entry corresponding to the value of the motion vector," and the addressees of the eight array entries which show the highest count represent the eight most common local vectors (Morgan page 15,

lines 5-19). As discussed above with respect to claim 1, Morgan does not discuss or show classifying motion vectors into sub-groups, and this section does not remedy this lacking. In addition, this section of Morgan is not remotely related to spatial clustering of motion vectors, and certainly does not classify block motion vectors according to such clustering. Rather, Morgan simply discloses using motion vectors to address a frequency array for the purposes of counting the occurrence of motion vectors and identifying the eight most common vectors.

For at least the foregoing reason, claim 2 is allowable over Morgan.

In addition, amended claim 7 recites additional features not disclosed in Morgan. Claim 7, as amended, recites “selecting and performing one of a plurality of motion estimation and search schemes based on selected characteristics of the primary and secondary global motion vectors, the plurality of motion estimation and search schemes employing various combinations of the global motion vectors and matching-block search window methods.” Morgan does not disclose plural motion estimation and search schemes or any selection between such schemes. Instead, Morgan discloses only a single motion estimation and search scheme in which a block matcher calculates correlation surfaces representing spatial correlation between blocks of two input fields, a correlation surface processor generates interpolated correlation surfaces, and a motion vector estimator that detects points of greatest correlation in the interpolated correlation surfaces (Morgan page 9, lines 4-12). Morgan is not specific as to how the block matcher, correlation surface processor, and motion estimator perform searching to estimate the motion vectors, but nowhere suggests that the searching is varied in any way or that there is any selection between plural searching schemes that employ various combinations of global motion vectors and matching-block search window methods as recited in amended claim 7.

Applicants disagree with the Examiner’s assertion that Morgan’s vector selection process discloses such recitations of claim 7 (Office Action page 10). Morgan describes the vector selection process as follows:

. . . The motion vector selector 230 supplies an output comprising one motion vector per pixel of the output field. This motion vector is selected from the four motion vectors for that block supplied by the motion vector reducer 220.

The vector selection process involves detecting the degree of correlation between test blocks of the two input fields pointed to by the motion vector under test. The

motion vector having the greatest degree of correlation between the test blocks is selected for use in interpolation of the output pixel. . . . (Morgan page 10, line 26, to page 11, line 8)

None of this section discloses any selection between plural motion estimation and search schemes. The Examiner asserts on page 10 of the Office Action:

Based on which motion vectors are selected the motion vector selector will test various areas of current and previous images. Therefore employ different block matching search window schemes because the search pattern defined by the test blocks will change as various motion vectors are selected.

However, as can be seen from a review of the quoted text of Morgan related to the vector selection process (above), Morgan does not discuss or suggest using different “motion estimation and search schemes,” but only discusses detecting the degree of correlation between test blocks of the two input fields pointed to by the motion vector under test. In particular, whatever motion estimation and search scheme Morgan employs appears to remain the same regardless of which candidate motion vector (of the four) is being tested; each vector simply points to test blocks so that a correlation test may be performed between the test blocks.

In addition, Applicants have amended claim 7 to further clarify aspects related to the plurality of motion estimation and search schemes. In particular, “the plurality of motion estimation and search schemes employ[] various combinations of the global motion vectors and matching-block search window methods.” Morgan does not disclose such a plurality of motion estimation and search schemes and does not select between them.

For at least the foregoing reasons, amended claim 7 is allowable over Morgan.

Claim 20 also recites additional functionality not disclosed in Morgan. In particular, claim 20 recites, *intra alia*, “determining initial secondary global motion vectors based on the determined primary global motion vector”. Morgan does not describe or show determining initial secondary global motion vectors based on a determined primary global motion vector. The Examiner does not point to anything in Morgan that remotely describes such functionality. Even if, as the Examiner asserts without support, “initial secondary global motion vectors will inherently be determined when evaluating the first frame” (Office Action page 4-5), there is no reason to suspect that such “inherent determination” is based on a determined primary

global motion vector. The Examiner simply has no support for rejecting claim 20, and Applicants are unable to find such support in Morgan.

For at least the foregoing reasons, claim 20 is allowable over Morgan.

Morgan also does not disclose the invention recited in amended claim 8. Claim 8, as amended, recites a motion estimation method that includes:

determining a plurality of global motion vectors for the selected group, each of the global motion vectors being formed from a plurality of the corresponding block motion vectors;

analyzing the global motion vectors and determining a metric representing a distribution pattern thereof;

selecting a motion estimator scheme on the basis of the distribution pattern metric, the motion estimator scheme being selected from amongst a plurality of motion estimator schemes each having a different combination of block-matching search methods and numbers of global motion vectors;

Morgan does not disclose the step of selecting a motion estimator scheme on the basis of the distribution pattern metric. As discussed above with respect to claim 7, Morgan does not disclose any selecting between plural motion estimator schemes. Additionally, Applicants have amended claim 8 to clarify that the plurality of motion estimator schemes each have "a different combination of block-matching search methods and numbers of global motion vectors." Morgan does not disclose such a plurality of motion estimator schemes that each have different combinations of block-matching search methods and numbers of global motion vectors, and certainly does not select between such motion estimator schemes. Furthermore, Morgan does not suggest selecting between motion estimator schemes based on a metric representing a distribution pattern of global motion vectors, as recited in claim 8.

For at least the foregoing reasons, claim 8 is not anticipated by Morgan.

Furthermore, Applicants have added new claim 25, which depends from claim 8, and recites that "the block-matching search methods [of claim 8] include one or more of exhaustive search methods, logarithmic search methods, hierarchical search methods, and multi-step search methods."

Amended claim 16 depends from claim 8, and thus is not anticipated by Morgan for at least those reasons. In addition, amended claim 16 recites, *intra alia*, “the determining step [of claim 8] includes classifying the block motion vectors from the selected group into a plurality of sub-groups; determining a primary global vector corresponding to all the block motion vectors from the selected group; and determining a plurality of secondary global motion vectors corresponding to the respective sub-groups from the block motion vectors classified in the respective sub-groups”. As discussed with respect to claim 1, Morgan does not disclose determining plural secondary global motion vectors corresponding to respective sub-groups, and does not determine such secondary global motion vectors from the block motion vectors classified in the respective sub-groups.

For at least the foregoing reasons, claim 16 is allowable over Morgan.

Although the language of independent claim 10 is not identical to claims 1 or 8, the allowability of claim 10 will be apparent in view of the foregoing discussions.

In addition, amended claim 18, depends from claim 10 and is allowable at least for those reasons discussed above, and although the language of amended claim 18 is not identical to claim 16, the allowability of claim 18 will be apparent in view of the discussion related to claim 16 as well.

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of US Patent No. 5,473,379 to Horne (“Horne”).

Morgan and Horne do not teach or suggest the invention recited in claim 3, which depends from claim 1. First, Horne does not teach or suggest any of the features of claim 1 that are missing from Morgan, such as determining a plurality of secondary global motion vectors corresponding to respective sub-groups. Second, Morgan does not disclose that secondary global motion vectors “are the average of their corresponding sub-group” as asserted by the Examiner (Office Action page 5, paragraph 4). Morgan’s method of counting the frequency of motion vectors is not analogous to computing secondary global motion vectors from an average of the block motion vectors within the respective sub-group—Morgan simply counts the occurrence of motion vectors.

In addition, Horne does not appear to teach or suggest computing primary and secondary global motion vectors from an average of block motion vectors within a respective corresponding group or sub-group as recited in claim 3. As the Examiner points out, Horne appears to describe calculating a global motion vector based on taking the average of motion vectors stored during the coding of a previous frame (Horne column 12, lines 20-24). A person of skill in the art would not be motivated to combine the teachings of Horne with Morgan, as counting the frequency of each local motion vector to identify global motion vectors (as described in Morgan) is incompatible with averaging those local motion vectors.

For at least this reason, claim 3 is patentable over the combination of Morgan and Horne.

Claims 6, 9, 17 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of U.S. Patent No. 5,428,396 to Yagasaki et al. ("Yagasaki"). Morgan and Yagasaki do not teach or suggest the invention recited in claim 6, which depends from amended claim 1, claims 9 and 17, which depend from claim 8, and claim 19, which depends from claim 10. Yagasaki does not teach or suggest the features of claim 1, 8, and 10 that are missing from Morgan. For example, Yagasaki's motion vector variable length coder (VLC) does not teach or suggest the primary and secondary global motion vectors of claim 1, and does not teach or suggest selecting between plural motion estimator schemes as recited in claims 8 and 10. Accordingly, claims 6, 9, 17 and 19 are nonobvious in view of Morgan and Yagasaki.

Claims 11-12 and 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of U.S. Patent No. 5,093,720 to Krause et al. ("Krause").

The combination of Morgan and Krause do not teach or suggest the invention recited in amended claim 11. Claim 11, as amended, recites an encoder that, *intra alia*, includes:

a selector coupled to receive the distribution pattern metric from the motion characteristics analyzer for selecting a motion estimation scheme from amongst a plurality of motion estimation schemes, for data block matching of at least one subsequent picture in the sequence, each of the plurality of motion

estimation schemes having a different combination of data block matching techniques and numbers of global motion vectors; and

a plurality of motion estimators controlled by said selector . . . for performing data block matching of at least one subsequent picture in the sequence using the selected motion estimation scheme . . .

Morgan and Krause do not teach or suggest the selector or motion estimators controlled by said selector as recited in amended claim 11. First, although Krause does show both an odd field motion estimator and an even field motion estimator, the motion estimators do not appear to use different combinations of data block matching techniques and numbers of global motion vectors as recited in claim 11. In particular, Krause states that “[t]he same double comparison is used for each block of odd field 100 of the current frame and for each block of the even field of the current frame” (Krause, column 4, lines 66-68).

In addition, Krause does not appear to have a selector for controlling a plurality of such motion estimators. For example, Krause appears to have a comparator which receives motion vectors from the odd and even field motion estimators and determines which of the received vectors is closest to the current frame block being processed (Krause, column 5, lines 61-65). Such a comparator is not analogous to a selector that controls a plurality of motion estimators for performing data block matching using selected motion estimation schemes as recited in claim 11.

For at least the foregoing reasons, amended claim 11 is allowable over the combination of Morgan and Krause.

Claims 12 and 14 depend from claim 11, and are thus allowable for at least those reasons discussed above.

Claims 13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of Krause and further in view of Yagasaki.

Claims 13 and 15 depend from claim 11, and thus are not taught or suggested by Morgan and Krause. In addition, Yagasaki does not teach or suggest the features of claim 11 that are missing from Morgan and Krause. Accordingly, claims 13 and 15 are nonobvious in view of the cited prior art.



Claims 21-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of an article entitled "Vector Quantization in Speech Coding" by Makhoul et al. ("Makhoul") and in further view of U.S. Patent No. 6,058,143 to Golin ("Golin").

Makhoul appears to discuss a clustering algorithm (the K-means algorithm) (Makhoul page 1557), and Golin appears discuss a clustering technique for motion vectors (Golin column 5, lines 49-57), but neither reference appears to teach or suggest the primary and secondary motion vectors of claim 1. Therefore, Makhoul and Golin do not appear to teach or suggest the features of claim 1 that are missing from Morgan. Claim 21-23 depend on claim 1, and are thus patentable over the combination of Morgan, Makhoul and Golin for at least the reasons discussed above with respect to claim 1.

New claim 24 depends from claim 1 and is thus allowable for the reasons discussed above with respect to claim 1. In addition, new claim 24 recites other features that are not taught or suggested by the cited prior art. For example, new claim 24 recites that "the primary global motion vector represents the average motion vector of the corresponding block motion vectors for the whole row."

New claim 25 depends from claim 8 and is thus allowable for the reasons discussed above with respect to claim 8. In addition, new claim 25 recites other features that are not taught or suggested by the cited prior art. For example, as discussed previously with respect to claim 8 above, claim 25 recites "the block-matching search methods [of claim 8] include one or more of exhaustive search methods, logarithmic search methods, hierarchical search methods, and multi-step search methods."

New claim 26 depends from claim 11 and is thus allowable for the reasons discussed above with respect to claim 11. In addition, new claim 26 recites other features that are not taught or suggested in the cited prior art. For example, new claim 26 recites that "the plurality of motion estimators [of claim 11] includes a first motion estimator configured to use one of the received global motion vectors and employ an exhaustive search block-matching technique, a second motion estimator configured to use two of the received global motion vectors and employ an exhaustive search block-matching technique, a third motion estimator configured to use one of the received global motion vectors and employ a hierarchical search

block-matching technique, and a fourth motion estimator configured to use two of the received global motion vectors and employ a hierarchical search block-matching technique.”

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable.  
Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,  
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